PATENT ABSTRACTS OF JAPAN

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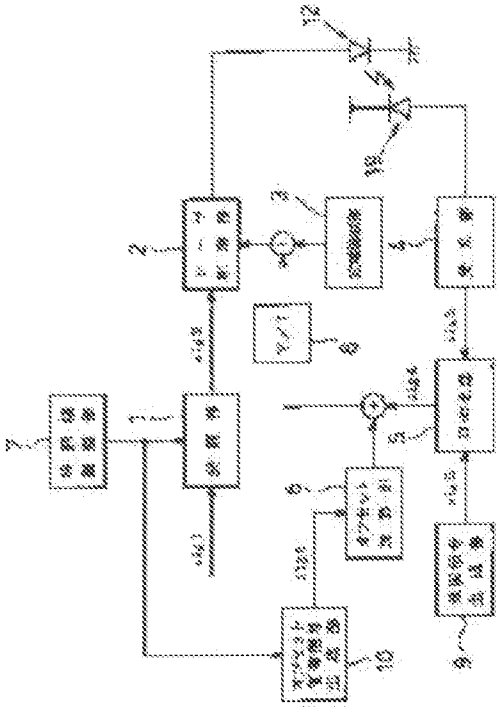
(71)Applicant : RICOH CO LTD

(72)Inventor : MAEKAWA HIROSHI

(54) CONTROL DEVICE FOR OUTPUT OF LASER



(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a control device by which a laser can be controlled to optimum laser light-emitting power always at low costs when information is recorded on, or reproduced from, an optical disk in a format by a CLV system by an optical-disk rotation control system other than the CLV system such as a CAV system or the like.

SOLUTION: A modulation part 1 modulates the control signal of the laser driving current of a laser diode 12 by a laser drive part 2 according to information to be recorded on a recording medium. A laser beam which is output from the laser diode 12 is received by a photodetector 19. The laser beam is converted into an electric signal by a light receiving part 4. The frequency characteristic of an averaging part 5 is changed by a speed signal sig5 from a speed-signal generation part 9. The averaging part 5 averages the electric signal which is converted by the light receiving part 4. The laser driving current is changed according to the averaged electric signal.

LEGAL STATUS

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CLAIMS

[Claim(s)]

[Claim 1] A modulation means to modulate the control signal of the laser drive current of a semiconductor laser component according to the information recorded on a record medium, A light-receiving means to receive the laser beam outputted from said semiconductor laser component, and to change into an electrical signal, In the laser power control device equipped with an equalization means to equalize the electrical signal changed by this means, and the control means which changes said laser drive current according to the electrical signal equalized by this means The laser power control device characterized by establishing the means which makes the frequency characteristics of said equalization means adjustable.

[Claim 2] The laser power control device characterized by establishing a radius location detection means to detect the radius location of the condensing point of the laser beam on said record medium, and a means to change the frequency characteristics of said equalization means according to the radius location detected by this means, in a laser power control device according to claim 1.

[Claim 3] The laser power control device characterized by establishing a rotational-speed detection means to detect the rotation information currently recorded on said record medium in a laser power control device according to claim 1, and a means to change the frequency characteristics of said equalization means according to the rotation information

detected by this means.
[Claim 4] The laser power control device characterized by establishing an offset addition means to add offset to the electrical signal equalized by said equalization means in a laser power control device according to claim 2, and a means to change the amount of offset added with this means according to the radius location detected by said radius location detection means.
[Claim 5] The laser power control device characterized by establishing an offset addition means to add offset to the electrical signal equalized by said equalization means in a laser power control device according to claim 3, and a means to change the amount of offset added with this means according to the rotation information detected by said rotational-speed detection means.
[Claim 6] The laser power control device characterized by to establish an offset addition means add offset to the electrical signal equalized by said equalization means in a laser power control device according to claim 2 or 3, the time-amount width-of-face adjustment device which changes the time-amount width of face of the control signal of the laser drive current modulated by said modulation means, and a means change the amount of offset according to the control signal with which time-amount width of face was changed with this means.
[Claim 7] In a laser power control device given in claim 1 thru/or any 1 term of 6 An optical-system means to irradiate a part of laser beam on said photo detector while condensing a laser beam on said record medium and condensing the reflected light from said record medium again on other different photo detectors from said photo detector, A playback means to detect the information on said record medium from a photo detector besides the above, A servo signal operation means to detect the positional information of said record medium and the condensed laser beam from a photo detector besides the above, A servo means to control the location of the laser beam on said record medium based on said positional information, The laser power control device characterized by establishing the device system means to which the location of said laser beam is moved, carrying out outgoing radiation of the laser beam from said semiconductor laser component based on said laser driving signal, and recording information on said record medium.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the laser power control device to which a recording rate is changed at the time of the information record to a record medium (media) in information record regenerative apparatus, such as optical disk drives, such as a phase change mold, and MO, WORM.

[0002]

[Description of the Prior Art] Since it is very sensitive to fluctuation of record power, it is necessary to supervise laser luminescence power and to maintain to fixed record power also during record, in record to a record medium (optical disk), and in order to form a record mark with high precision, the complicated optical power modulation is performed. Since such a complicated optical power modulation is performed, in order to detect all luminescence power, a high-speed detector and a high-speed control system are needed, and it will become expensive.

[0003] Then, conventionally, modulation data are superimposed, the laser beam which carried out the optical power modulation is equalized, a low-pass component is detected, and the method (for example, refer to JP,4-67260,B) which controls laser luminescence power by the control system carried out slowly is proposed. Moreover, the semi-conductor light emitting device output control of three or more values is possible, and the method (for example, refer to JP,8-96364,A) of the laser luminescence power average value control in the phase change media which enabled it to lower a photodetector military requirement is also proposed.

[0004] That is, by these methods, the laser output fluctuation of a low-pass component based on media rotation, a temperature change, etc. is detected, and the equalization means is equalizing the optical power modulation component of a reference clock frequency band based on the laser output fluctuation. According to such a conventional method, control of laser luminescence power is realizable by low cost.

[0005] By the way, in the current optical disk, a constant angular velocity rotary system ("CAV" is called) and a constant linear velocity rotary system ("CLV" is called) exist as a rotary system of an optical disk, and the ZCAV method and ZCLV method which combined those methods are also proposed.

[0006] The ZCAV method and ZCLV method divide an optical disk into radial in some zones, and are a method controlled by CAV or CLV, respectively in each zone. For example, the media format of CD, DVD, etc. represented as multimedia is CLV.

[0007] Since a format of the optical disk by this CLV can record inner circumference and a periphery with the same recording density, it is fit for large capacity-ization. However, since rotational speed also needed to be changed when the radius location to access changed, access was slow, the gear change control which changes rotational speed was difficult, and there was a problem that power consumption was large.

[0008] On the other hand, since linear velocity is as early as a periphery, recording density becomes coarse and does not turn [format / of the optical disk by CAV] to large capacity-ization, but since rotational speed is fixed, it does not have the latency time by gear change, and has the advantage that access is early.

[0009] Therefore, recently, the method which records and reproduces information by the roll control according the optical disk in the format by CLV to CAV is used. Since an informational recording rate and reproduction speed are changed with the radius location of an optical disk in the case of this method, record and in order to reproduce, it is necessary to change the frequency of the signal (clock) used as criteria.
[0010] Thus, since a clock frequency changes with the access radius of an optical disk when recording and reproducing information by the roll control according the optical disk formatted by CLV to CAV, optical power modulation frequency changes and a media rotational frequency also changes in the case where information is recorded and reproduced by the roll control by the ZCLV method or the ZCAV method.
[0011]
[Problem(s) to be Solved by the Invention] however, like the control system of the conventional laser luminescence power mentioned above If the frequency characteristics of an equalization means are made immobilization, when information will be recorded and reproduced by the roll control according the optical disk formatted by CLV to CAV, For example, since a laser power control band becomes very low compared with informational record reproduction speed on a periphery when an adjustment value is fixed to inner circumference side record reproduction speed The amount of information recorded or reproduced after laser power has shifted from the optimum value increased, and there was a problem that exact record and playback could not be performed.
[0012] Moreover, when an adjustment value was fixed to periphery side record reproduction speed, in inner circumference, an optical power modulation component would not decline and there was a problem of becoming the lack of equalization. Thus, with the equalization means which made frequency characteristics immobilization, there was a problem that always optimal laser luminescence power control could not be performed.
[0013] When this invention is made in view of the above-mentioned point and information is recorded or reproduced by optical disk roll control methods other than CLV, such as CAV, to the optical disk in the format by CLV, it aims at enabling it to control by low cost to the always optimal laser luminescence power.
[0014]
[Means for Solving the Problem] A modulation means to modulate the control signal of the laser drive current of a semiconductor laser component according to the information recorded on a record medium in order that this invention may attain the above-mentioned purpose, A light-receiving means to receive the laser beam outputted from the above-mentioned semiconductor laser component, and to change into an electrical signal, In the laser power control device equipped with an equalization means to equalize the electrical signal changed by the means, and the control means which changes the above-mentioned laser drive current according to the electrical signal equalized by the means, the means which makes adjustable the frequency characteristics of the above-mentioned equalization means is established.
[0015] Moreover, in the above laser power control devices, it is good to establish a radius location detection means to detect the radius location of the condensing point of the laser beam on the above-mentioned record medium, and a means to change the frequency characteristics of the above-mentioned equalization means according to the radius

location detected by the means.
[0016] Furthermore, in the above laser power control devices, it is good to establish a rotational-speed detection means to detect the rotation information currently recorded on the above-mentioned record medium, and a means to change the frequency characteristics of the above-mentioned equalization means according to the rotation information detected by the means.
[0017] Moreover, in the above laser power control devices, it is good to establish an offset addition means to add offset to the electrical signal equalized by the above-mentioned equalization means, and a means to change the amount of offset added with the means according to the radius location detected by the above-mentioned radius location detection means.
[0018] Furthermore, in the above laser power control devices, it is good to establish an offset addition means to add offset to the electrical signal equalized by the above-mentioned equalization means, and a means to change the amount of offset added with the means according to the rotation information detected by the above-mentioned rotational-speed detection means.
[0019] Moreover, in the above laser power control devices, it is good to establish an offset addition means to add offset to the electrical signal equalized by the above-mentioned equalization means, the time amount width-of-face adjustment device which changes the time amount width of face of the control signal of the laser drive current modulated by the above-mentioned modulation means, and a means to change the amount of offset according to the control signal with which time amount width of face was changed with the means.
[0020] Furthermore, in the above laser power control devices, a laser beam is condensed on the above-mentioned record medium. An optical-system means to irradiate a part of laser beam on the above-mentioned photo detector while condensing again the reflected light from the above-mentioned record medium on other different photo detectors from the above-mentioned photo detector, A playback means to detect the information on the above-mentioned record medium from a photo detector besides the above, A servo signal operation means to detect the positional information of the above-mentioned record medium and the condensed laser beam from a photo detector besides the above, A servo means to control the location of the laser beam on the above-mentioned record medium based on the above-mentioned positional information, It is good to establish the device system means to which the location of the above-mentioned laser beam is moved, to carry out outgoing radiation of the laser beam from the above-mentioned semiconductor laser component based on the above-mentioned laser driving signal, and to record information on the above-mentioned record medium.
[0021]
[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is concretely explained based on a drawing. Drawing 1 is the block diagram showing the configuration of the laser output-control section which is 1 operation gestalt of this invention.
[0022] The laser drive control signal of the laser mechanical component 2 according to recording-information signal:sig1 into which the modulation section 1 is inputted: Generate

sig2. This laser drive control signal: Make sig2 into the enable signal according to the luminescence level (for example, Pr, Ps, Pw) of a laser diode 12.
[0023] The laser mechanical component 2 chooses the output of the constant current source section 3 which responded for every luminescence level of a laser diode 12, drives a laser diode 12 and makes it emit light. A light sensing portion 4 connects the photo detector 17 arranged so that the laser beam by which outgoing radiation was carried out from the laser diode 12 can be received, changes into an electrical signal the laser beam which received light by the photo detector 17, and outputs the output signal:sig3.
[0024] From output-signal:sig3 to the recording-information signal into which frequency characteristics are adjustable and were inputted from the light sensing portion 4 by speed-signal:sig5 to which the equalization section 5 was outputted from the speed-signal generation section 9: Remove the optical power modulation component according to sig1, output by making it only luminescence level signal:sig4 of a reduction component, and adjust the output of the constant current source section 3 through the voltage-current converter (V/I) 8.
[0025] The control signal with which the offset adder unit 6 was outputted from the offset control-signal generation section 10: Adjust luminescence level signal:sig4 based on sig6. The time amount width-of-face controller 7 outputs the fine-tuning information which adjusts the optical power modulation width of face generated in the modulation section 1.
[0026] Drawing 2 is the block diagram showing the configuration of the information record regenerative apparatus equipped with the laser output-control section shown in drawing 1 . This information record regenerative apparatus inputs into the laser output-control section 11 the recording information outputted from the controller 27, and the laser driving signal outputted from the laser output-control section 11 drives a laser diode 12, and carries out outgoing radiation of the laser beam.
[0027] It is made concurrency light with a collimate lens 13, and is reflected by the beam splitter 14, and the laser beam by which outgoing radiation was carried out from the laser diode 12 is condensed with an objective lens 15 by the recording surface on a record medium (media) 30. The laser beam reflected by media 30 passes along an objective lens 15 again, passes a beam splitter 14, and makes it condense on a photo detector 17 with a condenser lens 16. And it is changed into an electrical signal by the photo detector 17, and a regenerative circuit 21, the servo signal arithmetic circuit 22, and the rotation information detector 23 are supplied.
[0028] On the other hand, it is condensed by the photo detector 19 with a condenser lens 18 as it is, and a part of laser beam by which outgoing radiation was carried out from the laser diode 12 is sent to the laser output-control section 11. Then, the information regenerative signal digitized in the regenerative circuit 21 is sent to a latter information demodulator circuit. Moreover, in the rotation information detector 23, the rotation information signal currently recorded on media 30 is detected.
[0029] For example, the wobble (Wobble) by meandering of a slot is minced so that the CD-R media formatted by CLV can be controlled by linear velocity regularity. Therefore, since a wobble is abbreviation fixed period = linear velocity regularity, if it is made to rotate by the roll control of CAV, a wobble can be used as a signal which is no longer a fixed period and shows linear velocity.

[0030] Moreover, in the servo signal arithmetic circuit 22, the positional information of the laser spot of the laser beam on media 30 is calculated, and based on the result of an operation, the servo circuit 24 moves the device system 20 using a servo motor 25, and controls the location of a laser spot by the directions received from the controller 27 to a target position. The servo motor 25 is equipped also with the media radial location detection function of the device system 20.

[0031] The speed signal inputted into the equalization section 5: sig(s)5 are the radius positional information signal outputted from the servo motor 25, and the rotation information signal outputted from the rotation information detector 23, and change the frequency characteristics of the equalization section 5 with this signal. Moreover, the servo circuit 24 controls the spindle motor 26 made to rotate media 30 based on the output from the rotation information detector 23.

[0032] That is, each part of the above achieves the following functions, respectively. The function of a modulation means by which the above-mentioned modulation section 1 modulates the control signal of the laser drive current of a semiconductor laser component according to the information recorded on a record medium is achieved, and the function of a light-receiving means for the above-mentioned light sensing portion 4 to receive the laser beam outputted from the semiconductor laser component, and to change into an electrical signal is achieved.

[0033] Moreover, the function of an equalization means by which the above-mentioned equalization section 5 equalizes the electrical signal changed by the light-receiving means is achieved, and the function of a control means in which the above-mentioned equalization section 5 and the voltage-current converter (V/I) 8 change a laser drive current according to the electrical signal equalized by the equalization means is achieved. Furthermore, the above-mentioned speed signal generation section 9 achieves the function of the means which makes the frequency characteristics of an equalization means adjustable.

[0034] Moreover, the above-mentioned servo motor 25 achieves the function of a radius location detection means to detect the radius location of the condensing point of the laser beam on the above-mentioned record medium, and the function of a means by which the above-mentioned speed signal generation section 9 changes the frequency characteristics of an equalization means according to the radius location detected by the radius location detection means is achieved.

[0035] Furthermore, the function of a rotational-speed detection means by which the above-mentioned rotation information detector 23 detects the rotation information currently recorded on the record medium is achieved, and the function of a means by which the above-mentioned speed signal generation section 9 changes the frequency characteristics of an equalization means according to the rotation information detected by the rotational-speed detection means is achieved.

[0036] Moreover, the function of the offset addition means of by which the above-mentioned offset adder unit 6 adds offset to the electrical signal equalized by the equalization means achieves, and the function of the means change the amount of offset which the offset control signal generation section 10 adds with an offset addition means according to the radius location detected by the radius location detection means, and the

means change the amount of offset add by the offset addition means according to the rotation information detected by the rotational-speed detection means achieves.
[0037] Moreover, the function of a time amount width-of-face adjustment device in which the above-mentioned time amount width-of-face controller 7 changes the time amount width of face of the control signal of the laser drive current modulated by the modulation means is achieved, and the function of a means by which the above-mentioned offset control signal generation section 10 changes the amount of offset according to the control signal with which time amount width of face was changed with the time amount width-of-face adjustment device is achieved.
[0038] Furthermore, while the above-mentioned laser diode 12 grade condenses a laser beam on a record medium and condenses the reflected light from a record medium again on other different photo detectors from a photo detector, the function of an optical-system means to irradiate a part of laser beam on a photo detector is achieved.
[0039] The above-mentioned regenerative circuit 21 achieves the function of a playback means to detect the information on a record medium from other photo detectors further again, and the above-mentioned servo signal arithmetic circuit 22 achieves a record medium and the function of a servo signal operation means to detect the positional information of the condensed laser beam, from other photo detectors.
[0040] And the above-mentioned servo circuit 24 and servo motor 25 grade achieve the function of a servo means control the location of the laser beam on a record medium based on positional information again, the above-mentioned device system 20 achieves the function of the device system means to which the location of a laser beam is moved, and the function of a means to by which the above-mentioned laser output-control section 11 carries out outgoing radiation of the laser beam from a semiconductor-laser component based on a laser driving signal, and records information on a record medium achieves.
[0041] Next, processing of this information record regenerative apparatus is explained. The laser output-control section 11 designs the addition-and-subtraction polarity of each signal so that the output value of the equalization section 5 may be set constant. For example, when a laser beam is made to emit light with a certain constant-current-power-supply output, if the temperature of a laser beam rises, luminescence power will fall.
[0042] Then, it designs in a reverse property so that that laser beam may be received and the output voltage of the equalization section 5 may be increased, if a current is added with the constant current source output current after V/I conversion of this output voltage, since a current will increase, laser power becomes large and the output of the equalization section 5 decreases, and it converges on constant value by repeating this. Namely, what is necessary is just to keep the output of the equalization section 5 constant, in order to keep laser luminescence power constant.
[0043] Drawing 3 is the diagram of the laser temperature characteristic. The temperature characteristic of the initial state of a laser diode 12 is target laser [are Ta and] luminescence power :P Laser drive current:Ia is required to output and accumulate a. However, if long duration luminescence is carried out, laser temperature will increase, the temperature characteristic is set to Tb, and a laser diode 12 is laser luminescence power also at the same laser drive current:Ia :P Only b emits light. Therefore, the control which

keeps a laser output constant also during record for forming an exact record mark is needed.

[0044] Drawing 4 is the diagram showing the frequency characteristics of the equalization section 5 when carrying out record playback of the information by CAV to the media formatted by CLV. Media rotational frequency:fsp is constant frequency because of CAV. However, reference clock frequency:finner of the inner circumference of media differs from reference clock frequency:fouter of a periphery for the media formatted by CLV.

[0045] If the frequency characteristics of the proper equalization section 5 through which the inner circumference of media and a periphery pass, respectively make inner circumference the direction shown by the drawing solid line and the direction shown by the dotted line is made into a periphery, they will turn into a reduction passage filter shape from which a reference clock frequency serves as specific magnitude-of-attenuation:Gclk.

[0046] In addition, since the laser power control band is very low on a periphery compared with informational record reproduction speed when the direction shown as a continuous line is made immobilization as frequency characteristics like before, the amount of information which carries out record playback after laser power has shifted from the optimum value increases, and exact record becomes impossible. Moreover, when the direction shown by the dotted line is made immobilization as frequency characteristics like before, in inner circumference, an optical power modulation component will not decline and it becomes the lack of equalization.

[0047] Furthermore, since not only a reference clock but media rotational frequency:fsp changes by the ZCLV method or the ZCAV method, it is effective not only a low pass filter but to put in a high pass filter (wavy line) frequency-characteristics adjustable with a frequency lower than media rotational frequency:fsp. It is a wave when that **** A shows inserts a high pass filter into drawing 4 .

[0048] Next, the signal which carries some kinds of filters about frequency-characteristics modification of the equalization section 5, and shows the recording rate at that time (speed signal): Change frequency characteristics by sig5. Moreover, it is also possible to set a reference clock to speed signal:sig5 otherwise, to carry out frequency-electrical-potential-difference conversion of this, and to constitute this electrical potential difference from a low pass filter which determines frequency characteristics as a control signal of a variable-capacity capacitor or a variable resistor.

[0049] Drawing 5 is the diagram showing actuation of output change of an optical power modulation and the equalization section 5. For example, as the above-mentioned information record regenerative apparatus, in the case of the optical disk drive recorded in an optical power modulation, especially the phase change type light disk drive which performs PWM (Pit Width Modulation) record and a WORM (postscript) disk drive, in order to form one record mark correctly, laser reinforcement is modulated to a high-speed multiple value.

[0050] (b) of drawing 5 is the diagram showing the example of the record light source on-the-strength modulated wave form of a phase change type light disk drive where the laser output of three values (Pr, Pe, Pw) was used, and (c) of drawing 5 is the diagram showing the example of the record light source on-the-strength modulated wave form of a WORM

disk drive where the binary (Pr, Pw) laser output was used. As for these waves, optimum conditions change with record film properties of a record medium.

[0051] This information record regenerative apparatus can be adapted for the recording method which modulates the reinforcement of the light source at a high-speed multiple value although not only the above-mentioned wave but a record mark is formed. In addition, (a) of drawing 5 shows the record mark 31 on the media truck corresponding to a record light source on-the-strength modulated wave form.

[0052] It is drawing which (d) of drawing 5 detected the luminescence wave of (b) of this drawing by the light sensing portion 4, and expressed the output wave of the equalization section 5, and (e) of drawing 5 is drawing which expressed the output wave of the equalization section 5 of (c) of this drawing similarly. Although the optical power modulation component according to recording information is equalized as shown in both drawings, the low-pass frequency component is the reflected wave.

[0053] Moreover, as mentioned above, media linear velocity becomes early, so that it progresses to a periphery in CAV, and the reference clock for carrying out record playback of the information on the same consistency also becomes early. In this case, it becomes difficult to form in the exact configuration (die length, width of face) of a record mark, and fine tuning of a record laser luminescence wave is needed.

[0054] For example, since heat will propagation-come to be hard to the record film of media like 1X in CD-R media, and 2X if linear velocity becomes early, laser power is strengthened. Moreover, by the media of CAV, since linear velocity differs on inner circumference and a periphery, record power is changed (for example, it enlarges on a periphery).

[0055] In this case, if it is controlling to become the constant value which fixed the output of the equalization section 5, record laser power does not become large. Therefore, by the offset adder unit 6, modification of the output of the equalization section 5 to arbitration can be enabled, and target record power can be changed.

[0056] Moreover, in order to form an exact record mark, it is good to change not only record laser power but the time amount width of face of an optical power modulation. With this time amount width of face, when generating optical power modulation width of face in the modulation section 1, it adjusts also including a finely tuned part not only according to the usual time amount width of face changed in proportion to a reference clock but linear velocity by sending fine-tuning information to the modulation section 1 from the time amount width-of-face controller 7.

[0057] Drawing 6 is drawing showing the output wave at the time of time amount width-of-face fine tuning of an optical power modulation. (a) of drawing 6 is drawing showing the optical power modulated wave form of three values (Pe, Pw, Pb) for forming the record mark piece of a certain die length, and (b) of this drawing is the wave form chart of the output signal of the equalization section 5.

[0058] In addition, a continuous line shows the optical power modulated wave form when recording information on (a) of drawing 6 by media inner circumference, and the continuous line shows the output signal of the equalization section 5 at that time to (b) of drawing 6 .

[0059] Since linear velocity is early on a media periphery, in order to obtain a desired

record mark, it tunes finely so that high-power luminescence time amount may be lengthened at (a) of drawing 6 , as a dotted line shows. However, if the output of the equalization section 5 which is desired value by tuning finely by the offset adder unit 6 is kept constant, it will be made for each power level (Pe, Pw, Pb) not to change, since it differs from the value in inner circumference as average power changes and the desired value of the equalization section 5 is also shown in (b) of drawing 6 .

[0060] Then, by the offset control signal generation section 10, the signal which shows modification of target power, such as information on a radius location, linear velocity, and an optical power modulation, is generated, and it inputs into the offset adder unit 6 as control signal:sig6.

[0061] Thus, since the information record regenerative apparatus of this operation gestalt makes the frequency characteristics of the equalization section 5 adjustable, when changing a recording rate, it can maintain the laser output stabilized with the cheap means.

[0062] Moreover, since the frequency characteristics of the equalization section 5 are changed by radius positional information, when a recording rate changes with a radius location, the laser output stabilized with the cheap means can be maintained.

[0063] Furthermore, since the frequency characteristics of the equalization section 5 are changed using the rotational-speed information currently recorded on media, it cannot be concerned with the rotation approach of media, but frequency characteristics can be adjusted to real time according to the present linear velocity, and the laser output stabilized with the cheap means can be maintained.

[0064] Moreover, since the amount of offset of the equalization section 5 is changed according to a radius location or rotational speed, also when changing record power according to a radius location or rotational speed, the desired value of a laser output can be changed easily and the laser output stabilized with the cheap means can be maintained.

[0065] Furthermore, since the amount of offset of the equalization section 5 is also changed in case the time amount width of face of an optical power modulated wave form is changed, a gap of the average by having changed time amount width of face can be amended, it can control to desired value, and the laser output stabilized with the cheap means can be maintained.

[0066] And when it applies to the equipment which changes the recording rates at the time of record of the information by the CAV to the media formatted by CLV etc., the cheap and stabilized laser output can be maintained.

[0067]

[Effect of the Invention] As explained above, when recording or reproducing information by optical disk roll control methods other than CLV, such as CAV, to the optical disk in the format by CLV according to the laser power control device by this invention, it can make it possible to control by low cost to the always optimal laser luminescence power.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the laser power control device to which a recording rate is changed at the time of the information record to a record medium (media) in information record regenerative apparatus, such as optical disk drives, such as a phase change mold, and MO, WORM.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
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PRIOR ART

[Description of the Prior Art] Since it is very sensitive to fluctuation of record power, it is necessary to supervise laser luminescence power and to maintain to fixed record power also during record, in record to a record medium (optical disk), and in order to form a record mark with high precision, the complicated optical power modulation is performed. Since such a complicated optical power modulation is performed, in order to detect all luminescence power, a high-speed detector and a high-speed control system are needed, and it will become expensive.

[0003] Then, conventionally, modulation data are superimposed, the laser beam which carried out the optical power modulation is equalized, a low-pass component is detected, and the method (for example, refer to JP,4-67260,B) which controls laser luminescence power by the control system carried out slowly is proposed. Moreover, the semi-conductor light emitting device output control of three or more values is possible, and the method (for example, refer to JP,8-96364,A) of the laser luminescence power average value control in the phase change media which enabled it to lower a photodetector military requirement is also proposed.

[0004] That is, by these methods, the laser output fluctuation of a low-pass component based on media rotation, a temperature change, etc. is detected, and the equalization means is equalizing the optical power modulation component of a reference clock frequency band based on the laser output fluctuation. According to such a conventional method, control of laser luminescence power is realizable by low cost.
[0005] By the way, in the current optical disk, a constant angular velocity rotary system ("CAV" is called) and a constant linear velocity rotary system ("CLV" is called) exist as a rotary system of an optical disk, and the ZCAV method and ZCLV method which combined those methods are also proposed.
[0006] The ZCAV method and ZCLV method divide an optical disk into radial in some zones, and are a method controlled by CAV or CLV, respectively in each zone. For example, the media format of CD, DVD, etc. represented as multimedia is CLV.
[0007] Since a format of the optical disk by this CLV can record inner circumference and a periphery with the same recording density, it is fit for large capacity-ization. However, since rotational speed also needed to be changed when the radius location to access changed, access was slow, the gear change control which changes rotational speed was difficult, and there was a problem that power consumption was large.
[0008] On the other hand, since linear velocity is as early as a periphery, recording density becomes coarse and does not turn [format / of the optical disk by CAV] to large capacity-ization, but since rotational speed is fixed, it does not have the latency time by gear change, and has the advantage that access is early.
[0009] Therefore, recently, the method which records and reproduces information by the roll control according the optical disk in the format by CLV to CAV is used. Since an informational recording rate and reproduction speed are changed with the radius location of an optical disk in the case of this method, record and in order to reproduce, it is necessary to change the frequency of the signal (clock) used as criteria.
[0010] Thus, since a clock frequency changes with the access radius of an optical disk when recording and reproducing information by the roll control according the optical disk formatted by CLV to CAV, optical power modulation frequency changes and a media rotational frequency also changes in the case where information is recorded and reproduced by the roll control by the ZCLV method or the ZCAV method.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, when recording or reproducing information by optical disk roll control methods other than CLV, such as CAV, to the optical disk in the format by CLV according to the laser power control device by this invention, it can make it possible to control by low cost to the always optimal laser luminescence power.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] however, like the control system of the conventional laser luminescence power mentioned above If the frequency characteristics of an equalization means are made immobilization, when information will be recorded and reproduced by the roll control according the optical disk formatted by CLV to CAV, For example, since a laser power control band becomes very low compared with informational record reproduction speed on a periphery when an adjustment value is fixed to inner circumference side record reproduction speed The amount of information recorded or reproduced after laser power has shifted from the optimum value increased, and there was a problem that exact record and playback could not be performed.
[0012] Moreover, when an adjustment value was fixed to periphery side record reproduction speed, in inner circumference, an optical power modulation component would not decline and there was a problem of becoming the lack of equalization. Thus, with the equalization means which made frequency characteristics immobilization, there was a problem that always optimal laser luminescence power control could not be performed.
[0013] When this invention is made in view of the above-mentioned point and information is recorded or reproduced by optical disk roll control methods other than CLV, such as CAV, to the optical disk in the format by CLV, it aims at enabling it to control by low cost to the always optimal laser luminescence power.

[Translation done.]

MEANS

[Means for Solving the Problem] A modulation means to modulate the control signal of the laser drive current of a semiconductor laser component according to the information recorded on a record medium in order that this invention may attain the above-mentioned purpose, A light-receiving means to receive the laser beam outputted from the above-mentioned semiconductor laser component, and to change into an electrical signal, In the laser power control device equipped with an equalization means to equalize the electrical signal changed by the means, and the control means which changes the above-mentioned laser drive current according to the electrical signal equalized by the means, the means which makes adjustable the frequency characteristics of the above-mentioned equalization means is established.
[0015] Moreover, in the above laser power control devices, it is good to establish a radius location detection means to detect the radius location of the condensing point of the laser beam on the above-mentioned record medium, and a means to change the frequency characteristics of the above-mentioned equalization means according to the radius location detected by the means.
[0016] Furthermore, in the above laser power control devices, it is good to establish a rotational-speed detection means to detect the rotation information currently recorded on the above-mentioned record medium, and a means to change the frequency characteristics of the above-mentioned equalization means according to the rotation information detected by the means.
[0017] Moreover, in the above laser power control devices, it is good to establish an offset addition means to add offset to the electrical signal equalized by the above-mentioned equalization means, and a means to change the amount of offset added with the means according to the radius location detected by the above-mentioned radius location detection means.
[0018] Furthermore, in the above laser power control devices, it is good to establish an offset addition means to add offset to the electrical signal equalized by the above-mentioned equalization means, and a means to change the amount of offset added with the means according to the rotation information detected by the above-mentioned rotational-speed detection means.
[0019] Moreover, in the above laser power control devices, it is good to establish an offset addition means to add offset to the electrical signal equalized by the above-mentioned equalization means, the time amount width-of-face adjustment device which changes the time amount width of face of the control signal of the laser drive current

modulated by the above-mentioned modulation means, and a means to change the amount of offset according to the control signal with which time amount width of face was changed with the means.

[0020] Furthermore, in the above laser power control devices, a laser beam is condensed on the above-mentioned record medium. An optical-system means to irradiate a part of laser beam on the above-mentioned photo detector while condensing again the reflected light from the above-mentioned record medium on other different photo detectors from the above-mentioned photo detector, A playback means to detect the information on the above-mentioned record medium from a photo detector besides the above, A servo signal operation means to detect the positional information of the above-mentioned record medium and the condensed laser beam from a photo detector besides the above, A servo means to control the location of the laser beam on the above-mentioned record medium based on the above-mentioned positional information, It is good to establish the device system means to which the location of the above-mentioned laser beam is moved, to carry out outgoing radiation of the laser beam from the above-mentioned semiconductor laser component based on the above-mentioned laser driving signal, and to record information on the above-mentioned record medium.

[0021]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is concretely explained based on a drawing. Drawing 1 is the block diagram showing the configuration of the laser output-control section which is 1 operation gestalt of this invention.

[0022] The laser drive control signal of the laser mechanical component 2 according to recording-information signal:sig1 into which the modulation section 1 is inputted: Generate sig2. This laser drive control signal: Make sig2 into the enable signal according to the luminescence level (for example, Pr, Pe, Pw) of a laser diode 12.

[0023] The laser mechanical component 2 chooses the output of the constant current source section 3 which responded for every luminescence level of a laser diode 12, drives a laser diode 12 and makes it emit light. A light sensing portion 4 connects the photo detector 17 arranged so that the laser beam by which outgoing radiation was carried out from the laser diode 12 can be received, changes into an electrical signal the laser beam which received light by the photo detector 17, and outputs the output signal:sig3.

[0024] From output-signal:sig3 to the recording-information signal into which frequency characteristics are adjustable and were inputted from the light sensing portion 4 by speed-signal:sig5 to which the equalization section 5 was outputted from the speed-signal generation section 9: Remove the optical power modulation component according to sig1, output by making it only luminescence level signal:sig4 of a reduction component, and adjust the output of the constant current source section 3 through the voltage-current converter (V/I) 8.

[0025] The control signal with which the offset adder unit 6 was outputted from the offset control-signal generation section 10: Adjust luminescence level signal:sig4 based on sig6. The time amount width-of-face controller 7 outputs the fine-tuning information which adjusts the optical power modulation width of face generated in the modulation section 1.

[0026] Drawing 2 is the block diagram showing the configuration of the information record

regenerative apparatus equipped with the laser output-control section shown in drawing 1 . This information record regenerative apparatus inputs into the laser output-control section 11 the recording information outputted from the controller 27, and the laser driving signal outputted from the laser output-control section 11 drives a laser diode 12, and carries out outgoing radiation of the laser beam.

[0027] It is made concurrency light with a collimate lens 13, and is reflected by the beam splitter 14, and the laser beam by which outgoing radiation was carried out from the laser diode 12 is condensed with an objective lens 15 by the recording surface on a record medium (media) 30. The laser beam reflected by media 30 passes along an objective lens 15 again, passes a beam splitter 14, and makes it condense on a photo detector 17 with a condenser lens 16. And it is changed into an electrical signal by the photo detector 17, and a regenerative circuit 21, the servo signal arithmetic circuit 22, and the rotation information detector 23 are supplied.

[0028] On the other hand, it is condensed by the photo detector 19 with a condenser lens 18 as it is, and a part of laser beam by which outgoing radiation was carried out from the laser diode 12 is sent to the laser output-control section 11. Then, the information regenerative signal digitized in the regenerative circuit 21 is sent to a latter information demodulator circuit. Moreover, in the rotation information detector 23, the rotation information signal currently recorded on media 30 is detected.

[0029] For example, the wobble (Wobble) by meandering of a slot is minced so that the CD-R media formatted by CLV can be controlled by linear velocity regularity. Therefore, since a wobble is abbreviation fixed period = linear velocity regularity, if it is made to rotate by the roll control of CAV, a wobble can be used as a signal which is no longer a fixed period and shows linear velocity.

[0030] Moreover, in the servo signal arithmetic circuit 22, the positional information of the laser spot of the laser beam on media 30 is calculated, and based on the result of an operation, the servo circuit 24 moves the device system 20 using a servo motor 25, and controls the location of a laser spot by the directions received from the controller 27 to a target position. The servo motor 25 is equipped also with the media radial location detection function of the device system 20.

[0031] The speed signal inputted into the equalization section 5: sig(s)5 are the radius positional information signal outputted from the servo motor 25, and the rotation information signal outputted from the rotation information detector 23, and change the frequency characteristics of the equalization section 5 with this signal. Moreover, the servo circuit 24 controls the spindle motor 26 made to rotate media 30 based on the output from the rotation information detector 23.

[0032] That is, each part of the above achieves the following functions, respectively. The function of a modulation means by which the above-mentioned modulation section 1 modulates the control signal of the laser drive current of a semiconductor laser component according to the information recorded on a record medium is achieved, and the function of a light-receiving means for the above-mentioned light sensing portion 4 to receive the laser beam outputted from the semiconductor laser component, and to change into an electrical signal is achieved.

[0033] Moreover, the function of an equalization means by which the above-mentioned

equalization section 5 equalizes the electrical signal changed by the light-receiving means is achieved, and the function of a control means in which the above-mentioned equalization section 5 and the voltage-current converter (V/I) 6 change a laser drive current according to the electrical signal equalized by the equalization means is achieved. Furthermore, the above-mentioned speed signal generation section 9 achieves the function of the means which makes the frequency characteristics of an equalization means adjustable.

[0034] Moreover, the above-mentioned servo motor 25 achieves the function of a radius location detection means to detect the radius location of the condensing point of the laser beam on the above-mentioned record medium, and the function of a means by which the above-mentioned speed signal generation section 9 changes the frequency characteristics of an equalization means according to the radius location detected by the radius location detection means is achieved.

[0035] Furthermore, the function of a rotational-speed detection means by which the above-mentioned rotation information detector 23 detects the rotation information currently recorded on the record medium is achieved, and the function of a means by which the above-mentioned speed signal generation section 9 changes the frequency characteristics of an equalization means according to the rotation information detected by the rotational-speed detection means is achieved.

[0036] Moreover, the function of the offset addition means of by which the above-mentioned offset adder unit 6 adds offset to the electrical signal equalized by the equalization means achieves, and the function of the means change the amount of offset which the offset control signal generation section 10 adds with an offset addition means according to the radius location detected by the radius location detection means, and the means change the amount of offset add by the offset addition means according to the rotation information detected by the rotational-speed detection means achieves.

[0037] Moreover, the function of a time amount width-of-face adjustment device in which the above-mentioned time amount width-of-face controller 7 changes the time amount width of face of the control signal of the laser drive current modulated by the modulation means is achieved, and the function of a means by which the above-mentioned offset control signal generation section 10 changes the amount of offset according to the control signal with which time amount width of face was changed with the time amount width-of-face adjustment device is achieved.

[0038] Furthermore, while the above-mentioned laser diode 12 grade condenses a laser beam on a record medium and condenses the reflected light from a record medium again on other different photo detectors from a photo detector, the function of an optical-system means to irradiate a part of laser beam on a photo detector is achieved.

[0039] The above-mentioned regenerative circuit 21 achieves the function of a playback means to detect the information on a record medium from other photo detectors further again, and the above-mentioned servo signal arithmetic circuit 22 achieves a record medium and the function of a servo signal operation means to detect the positional information of the condensed laser beam, from other photo detectors.

[0040] And the above-mentioned servo circuit 24 and servo motor 25 grade achieve the function of a servo means control the location of the laser beam on a record medium

based on positional information again, the above-mentioned device system 20 achieves the function of the device system means to which the location of a laser beam is moved, and the function of a means to by_which the above-mentioned laser output-control section 11 carries out outgoing radiation of the laser beam from a semiconductor-laser component based on a laser driving signal, and records information on a record medium achieves.

[0041] Next, processing of this information record regenerative apparatus is explained. The laser output-control section 11 designs the addition-and-subtraction polarity of each signal so that the output value of the equalization section 5 may be set constant. For example, when a laser beam is made to emit light with a certain constant-current-power-supply output, if the temperature of a laser beam rises, luminescence power will fall.

[0042] Then, it designs in a reverse property so that that laser beam may be received and the output voltage of the equalization section 5 may be increased, if a current is added with the constant current source output current after V/I conversion of this output voltage, since a current will increase, laser power becomes large and the output of the equalization section 5 decreases, and it converges on constant value by repeating this. Namely, what is necessary is just to keep the output of the equalization section 5 constant, in order to keep laser luminescence power constant.

[0043] Drawing 3 is the diagram of the laser temperature characteristic. The temperature characteristic of the initial state of a laser diode 12 is target laser [are Ta and] luminescence power :P Laser drive current:Ia is required to output and accumulate a. However, if long duration luminescence is carried out, laser temperature will increase, the temperature characteristic is set to Tb, and a laser diode 12 is laser luminescence power also at the same laser drive current:Ia :P Only b emits light. Therefore, the control which keeps a laser output constant also during record for forming an exact record mark is needed.

[0044] Drawing 4 is the diagram showing the frequency characteristics of the equalization section 5 when carrying out record playback of the information by CAV to the media formatted by CLV. Media rotational frequency:fsp is constant frequency because of CAV. However, reference clock frequency:finner of the inner circumference of media differs from reference clock frequency:fouter of a periphery for the media formatted by CLV.

[0045] If the frequency characteristics of the proper equalization section 5 through which the inner circumference of media and a periphery pass, respectively make inner circumference the direction shown by the drawing solid line and the direction shown by the dotted line is made into a periphery, they will turn into a reduction passage filter shape from which a reference clock frequency serves as specific magnitude-of-attenuation:Gclk.

[0046] In addition, since the laser power control band is very low on a periphery compared with informational record reproduction speed when the direction shown as a continuous line is made immobilization as frequency characteristics like before, the amount of information which carries out record playback after laser power has shifted from the optimum value increases, and exact record becomes impossible. Moreover, when the direction shown by the dotted line is made immobilization as frequency characteristics like before, in inner circumference, an optical power modulation component will not decline and

it becomes the lack of equalization.

[0047] Furthermore, since not only a reference clock but media rotational frequency:fsp changes by the ZCLV method or the ZCAV method, it is effective not only a low pass filter but to put in a high pass filter (wavy line) frequency-characteristics adjustable with a frequency lower than media rotational frequency:fsp. It is a wave when that **** A shows inserts a high pass filter into drawing 4 .

[0048] Next, the signal which carries some kinds of filters about frequency-characteristics modification of the equalization section 5, and shows the recording rate at that time (speed signal): Change frequency characteristics by sig5. Moreover, it is also possible to set a reference clock to speed signal:sig5 otherwise, to carry out frequency-electrical-potential-difference conversion of this, and to constitute this electrical potential difference from a low pass filter which determines frequency characteristics as a control signal of a variable-capacity capacitor or a variable resistor.

[0049] Drawing 5 is the diagram showing actuation of output change of an optical power modulation and the equalization section 5. For example, as the above-mentioned information record regenerative apparatus, in the case of the optical disk drive recorded in an optical power modulation, especially the phase change type light disk drive which performs PWM (Pit Width Modulation) record and a WORM (postscript) disk drive, in order to form one record mark correctly, laser reinforcement is modulated to a high-speed multiple value.

[0050] (b) of drawing 5 is the diagram showing the example of the record light source on-the-strength modulated wave form of a phase change type light disk drive where the laser output of three values (Pr, Pe, Pw) was used, and (c) of drawing 5 is the diagram showing the example of the record light source on-the-strength modulated wave form of a WORM disk drive where the binary (Pr, Pw) laser output was used. As for these waves, optimum conditions change with record film properties of a record medium.

[0051] This information record regenerative apparatus can be adapted for the recording method which modulates the reinforcement of the light source at a high-speed multiple value although not only the above-mentioned wave but a record mark is formed. In addition, (a) of drawing 5 shows the record mark 31 on the media truck corresponding to a record light source on-the-strength modulated wave form.

[0052] It is drawing which (d) of drawing 5 detected the luminescence wave of (b) of this drawing by the light sensing portion 4, and expressed the output wave of the equalization section 5, and (e) of drawing 5 is drawing which expressed the output wave of the equalization section 5 of (c) of this drawing similarly. Although the optical power modulation component according to recording information is equalized as shown in both drawings, the low-pass frequency component is the reflected wave.

[0053] Moreover, as mentioned above, media linear velocity becomes early, so that it progresses to a periphery in CAV, and the reference clock for carrying out record playback of the information on the same consistency also becomes early. In this case, it becomes difficult to form in the exact configuration (die length, width of face) of a record mark, and fine tuning of a record laser luminescence wave is needed.

[0054] For example, since heat will propagation-come to be hard to the record film of media like 1X in CD-R media, and 2X if linear velocity becomes early, laser power is

strengthened. Moreover, by the media of CAV, since linear velocity differs on inner circumference and a periphery, record power is changed (for example, it enlarges on a periphery).

[0055] In this case, if it is controlling to become the constant value which fixed the output of the equalization section 5, record laser power does not become large. Therefore, by the offset adder unit 6, modification of the output of the equalization section 5 to arbitration can be enabled, and target record power can be changed.

[0056] Moreover, in order to form an exact record mark, it is good to change not only record laser power but the time amount width of face of an optical power modulation. With this time amount width of face, when generating optical power modulation width of face in the modulation section 1, it adjusts also including a finely tuned part not only according to the usual time amount width of face changed in proportion to a reference clock but linear velocity by sending fine-tuning information to the modulation section 1 from the time amount width-of-face controller 7.

[0057] Drawing 6 is drawing showing the output wave at the time of time amount width-of-face fine tuning of an optical power modulation. (a) of drawing 6 is drawing showing the optical power modulated wave form of three values (Pe, Pw, Pb) for forming the record mark piece of a certain die length, and (b) of this drawing is the wave form chart of the output signal of the equalization section 5.

[0058] In addition, a continuous line shows the optical power modulated wave form when recording information on (a) of drawing 6 by media inner circumference, and the continuous line shows the output signal of the equalization section 5 at that time to (b) of drawing 6 .

[0059] Since linear velocity is early on a media periphery, in order to obtain a desired record mark, it tunes finely so that high-power luminescence time amount may be lengthened at (a) of drawing 6 , as a dotted line shows. However, if the output of the equalization section 5 which is desired value by tuning finely by the offset adder unit 6 is kept constant, it will be made for each power level (Pe, Pw, Pb) not to change, since it differs from the value in inner circumference as average power changes and the desired value of the equalization section 5 is also shown in (b) of drawing 6 .

[0060] Then, by the offset control signal generation section 10, the signal which shows modification of target power, such as information on a radius location, linear velocity, and an optical power modulation, is generated, and it inputs into the offset adder unit 6 as control signal:sig6.

[0061] Thus, since the information record regenerative apparatus of this operation gestalt makes the frequency characteristics of the equalization section 5 adjustable, when changing a recording rate, it can maintain the laser output stabilized with the cheap means.

[0062] Moreover, since the frequency characteristics of the equalization section 5 are changed by radius positional information, when a recording rate changes with a radius location, the laser output stabilized with the cheap means can be maintained.

[0063] Furthermore, since the frequency characteristics of the equalization section 5 are changed using the rotational-speed information currently recorded on media, it cannot be concerned with the rotation approach of media, but frequency characteristics can be adjusted to real time according to the present linear velocity, and the laser output

stabilized with the cheap means can be maintained.
[0064] Moreover, since the amount of offset of the equalization section 5 is changed according to a radius location or rotational speed, also when changing record power according to a radius location or rotational speed, the desired value of a laser output can be changed easily and the laser output stabilized with the cheap means can be maintained.
[0065] Furthermore, since the amount of offset of the equalization section 5 is also changed in case the time amount width of face of an optical power modulated wave form is changed, a gap of the average by having changed time amount width of face can be amended, it can control to desired value, and the laser output stabilized with the cheap means can be maintained.
[0066] And when it applies to the equipment which changes the recording rates at the time of record of the information by the CAV to the media formatted by CLV etc., the cheap and stabilized laser output can be maintained.

[Translation done.]

DESCRIPTION OF DRAWINGS

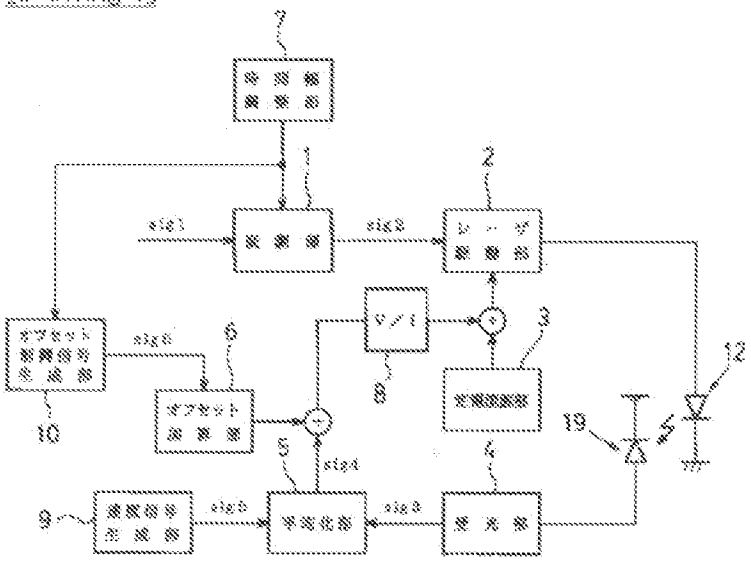
[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the configuration of the laser output-control section which is 1 operation gestalt of this invention.
[Drawing 2] It is the block diagram showing the configuration of the information record regenerative apparatus equipped with the laser output-control section shown in drawing 1.
[Drawing 3] It is the diagram of the laser temperature characteristic.
[Drawing 4] It is the diagram showing the frequency characteristics of the equalization section 5 when carrying out record playback of the information by CAV to the media formatted by CLV.
[Drawing 5] It is the diagram showing actuation of output change of an optical power modulation and the equalization section 5.
[Drawing 6] It is drawing showing the output wave at the time of time amount width-of-face fine tuning of an optical power modulation.
[Description of Notations]
1: Modulation section 2: Laser mechanical component

3: Constant current source section 4: Light sensing portion
5: Equalization section 6: Offset adder unit
7: Time amount width-of-face controller 8: Voltage-current converter (V/I)
9: Speed signal generation section
10: Offset control signal generation section
11: Laser output-control section 12: Laser diode
13: Collimate lens 14: Beam splitter
15: Objective lens 16: Condenser lens
17: Photo detector 18: Condenser lens
19: Photo detector 20: Device system
21: Regenerative circuit 22: Servo signal arithmetic circuit
23: Rotation information detector 24: Servo circuit
25: Servo motor 26: Spindle motor
27: Controller 30: Record medium (media)
sig1: Recording information signal
sig2: Laser drive control signal
sig3: The output signal from a light sensing portion
sig4: Luminescence level signal
sig5: Speed signal
sig6: Control signal

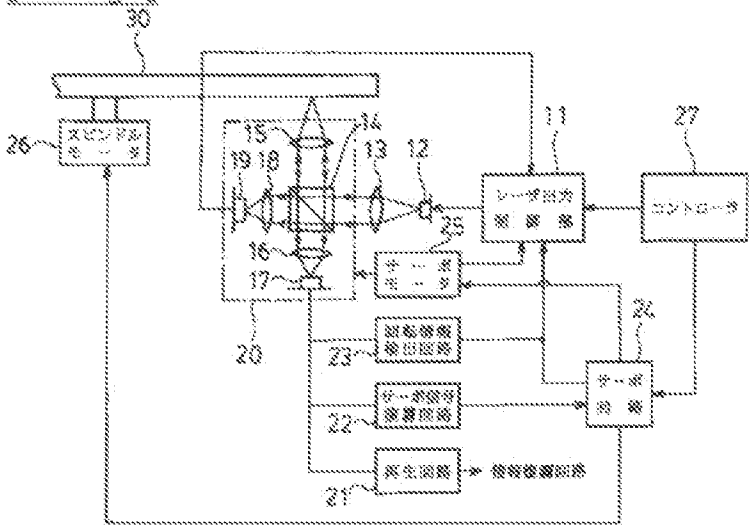
[Translation done.]

DRAWINGS

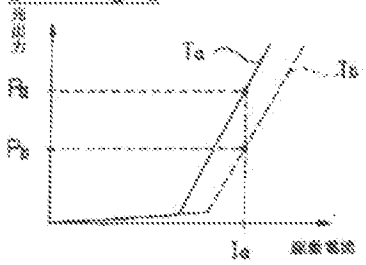
[Drawing 1]



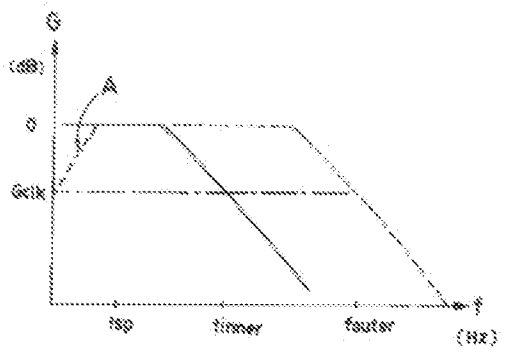
[Drawing 2]



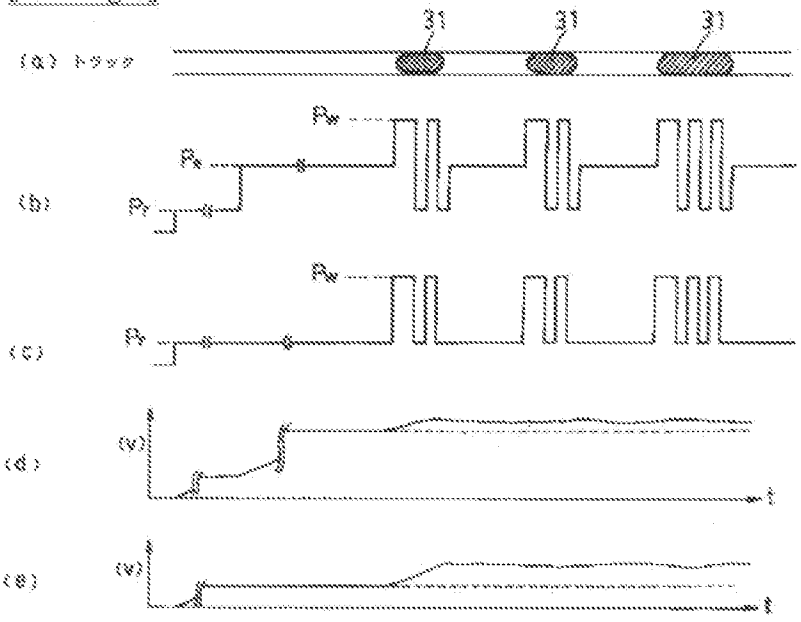
[Drawing 3]



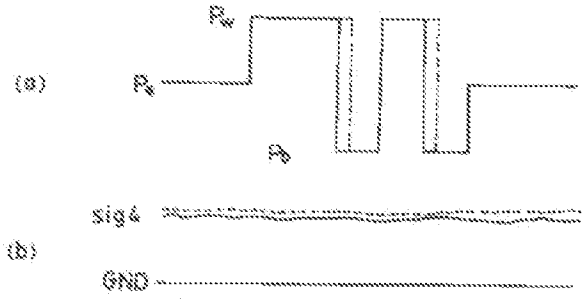
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]

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(71)出願人　000004747
株式会社リコー
東京都大田区中馬込１丁目３番６号

(72)発明者　前川　博史
東京都大田区中馬込１丁目３番６号　株式会社リコー内

(74)代理人　100098921
弁理士　大澤　敬

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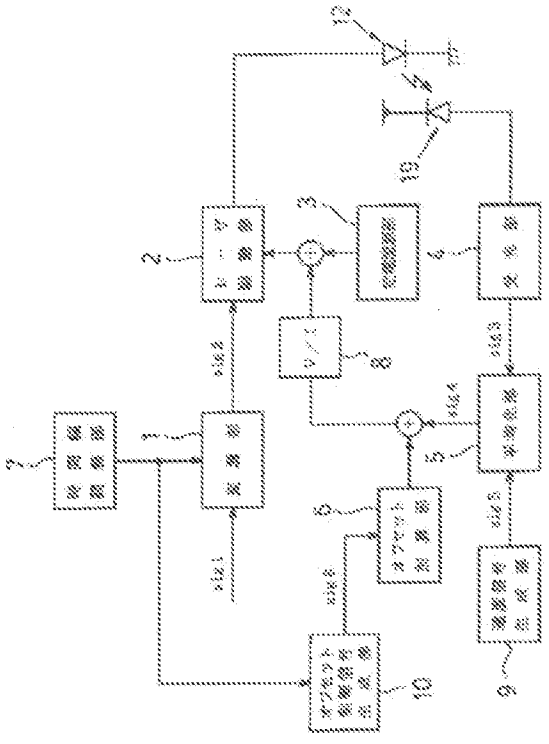
(54)【発明の名称】レーザ出力制御装置

(57)【要約】
【課題】　ＣＬＶ方式によるフォーマットの光ディスクにＣＡＶ方式等のＣＬＶ以外の光ディスク回転制御方式で情報を記録又は再生するとき、低コストで常に最適なレーザ発光パワーに制御できるようにする。
【解決手段】　変調器１が記録媒体上に記録する情報に応じてレーザ駆動部３によるレーザダイオード１２のレーザ駆動電流の制御信号を変調し、受光素子１９によってレーザダイオード１２から出力されたレーザ光を受光し、受光部４によってそのレーザ光を電気信号に変換し、速度信号生成部９からの速度信号：ｓｉｇ５によって平均化部５の周波数特性を変更し、平均化部５が受光部４によって変換された電気信号を平均化し、その平均化された電気信号に応じてレーザ駆動電流を変更する。



【特許請求の範囲】
【請求項１】　記録媒体上に記録する情報に応じて半導体レーザ素子のレーザ駆動電流の制御信号を変調する変調手段と、前記半導体レーザ素子から出力されたレーザ光を受光して電気信号に変換する受光手段と、該手段によって変換された電気信号を平均化する平均化手段と、該手段によって平均化された電気信号に応じて前記レーザ駆動電流を変更する制御手段を備えたレーザ出力制御装置において、
前記平均化手段の周波数特性を可変にする手段を設けたことを特徴とするレーザ出力制御装置。
【請求項２】　請求項１記載のレーザ出力制御装置において、
前記記録媒体上のレーザ光の集光点の半径位置を検出する半径位置検出手段と、該手段によって検出された半径位置に応じて前記平均化手段の周波数特性を変更する手段とを設けたことを特徴とするレーザ出力制御装置。
【請求項３】　請求項１記載のレーザ出力制御装置において、
前記記録媒体上に記録されている回転情報を検出する回転速度検出手段と、該手段によって検出された回転情報に応じて前記平均化手段の周波数特性を変更する手段を設けたことを特徴とするレーザ出力制御装置。
【請求項４】　請求項２記載のレーザ出力制御装置において、
前記平均化手段によって平均化された電気信号にオフセットを加えるオフセット加算手段と、該手段によって加算するオフセット量を前記半径位置検出手段によって検出された半径位置に応じて変更する手段を設けたことを特徴とするレーザ出力制御装置。
【請求項５】　請求項３記載のレーザ出力制御装置において、
前記平均化手段によって平均化された電気信号にオフセットを加えるオフセット加算手段と、該手段によって加算するオフセット量を前記回転速度検出手段によって検出された回転情報に応じて変更する手段を設けたことを特徴とするレーザ出力制御装置。
【請求項６】　請求項２又は３記載のレーザ出力制御装置において、
前記平均化手段によって平均化された電気信号にオフセットを加えるオフセット加算手段と、前記変調手段によって変調されたレーザ駆動電流の制御信号の時間幅を変更する時間幅調整手段と、該手段によって時間幅が変更された制御信号に応じてオフセット量を変更する手段を設けたことを特徴とするレーザ出力制御装置。
【請求項７】　請求項１乃至６のいずれか一項に記載のレーザ出力制御装置において、
前記記録媒体上にレーザ光を集光し、前記記録媒体からの反射光を前記受光素子とは異なる他の受光素子上に再び集光するとともにレーザ光の一部を前記受光素子上に照射する光学系手段と、前記他の受光素子から前記記録媒体上の情報を検出する再生手段と、前記他の受光素子から前記記録媒体と集光されたレーザ光の位置情報を検出するサーボ信号演算手段と、前記位置情報に基づいて前記記録媒体上のレーザ光の位置を制御するサーボ手段と、前記レーザ光の位置を移動させる機構系手段とを設け、前記レーザ駆動信号に基づいて前記半導体レーザ素子からレーザ光を出射して前記記録媒体上に情報を記録するようにしたことを特徴とするレーザ出力制御装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、相変化型、ＭＯ，ＷＯＲＭ等の光ディスクドライブ等の情報記録再生装置において、記録媒体（メディア）への情報記録時に記録速度を変化させるレーザ出力制御装置に関する。
【０００２】
【従来の技術】記録媒体（光ディスク）への記録では非常に記録パワーの変動に敏感であるので記録中もレーザ発光パワーを監視し、一定の記録パワーに維持する必要があるが、高精度に記録マークを形成するために複雑な光パワー変調を行なっている。このような複雑な光パワー変調を行なっているので全ての発光パワーを検出するには、高速な検出器と高速な制御系が必要となり高価なものとなる。
【０００３】そこで従来、変調データを重畳して光パワー変調したレーザ光を平均化して低域成分を検出し、ゆっくりとした制御系でレーザ発光パワーの制御を行なう方式（例えば、特公平４－６７２６０号公報参照）が提案されている。また、３値以上の半導体発光素子出力制御が可能で光検出器要求性能を下げることができるようにした相変化メディアにおけるレーザ発光パワー平均値制御の方式（例えば、特開平８－９６３８４号公報参照）も提案されている。
【０００４】すなわち、これらの方式では、メディア回転や温度変化等に基づく低域成分のレーザ出力変動を検出し、そのレーザ出力変動に基づいて平均化手段が基準クロック周波数帯域の光パワー変調成分を平均化している。このような従来の方式によれば、レーザ発光パワーの制御を低コストで実現することができる。
【０００５】ところで、現在の光ディスクでは、光ディスクの回転方式として角速度一定回転方式（「ＣＡＶ方式」と称する）と線速度一定回転方式（「ＣＬＶ方式」と称する）が存在し、それらの方式を組み合わせたＺＣＡＶ方式やＺＣＬＶ方式も提案されている。
【０００６】そのＺＣＡＶ方式とＺＣＬＶ方式は、光ディスクを半径方向にいくつかのゾーンに分割し、各ゾーンではそれぞれＣＡＶ方式又はＣＬＶ方式で制御する方式である。例えば、マルチメディアとして代表されるＣＤやＤＶＤ等のメディアフォーマットはＣＬＶ方式である。

【０００７】このＣＬＶ方式による光ディスクのフォーマットは、内周も外周も同じ記録密度で記録できるので、大容量化に向いている。しかし、アクセスする半径位置が変わると回転速度も変える必要があるので、アクセスが遅く、回転速度を変える変速制御が難しく、消費電力が大きいという問題があった。

【０００８】一方、ＣＡＶ方式による光ディスクのフォーマットは、外周ほど線速が早いために記録密度が粗くなり、大容量化には向かないが、回転速度が一定なので、変速による待ち時間が無く、アクセスが早いという利点がある。

【０００９】したがって、最近ではＣＬＶ方式によるフォーマットの光ディスクをＣＡＶ方式による回転制御で情報を記録及び再生する方式が利用されている。この方式の場合、光ディスクの半径位置によって情報の記録速度及び再生速度を変化させるので、記録や再生するために基準となる信号（クロック）の周波数を変える必要がある。

【００１０】このように、ＣＬＶ方式でフォーマットした光ディスクをＣＡＶ方式による回転制御で情報を記録及び再生する場合、光ディスクのアクセス半径によってクロック周波数が変わるため、光パワー変調周波数が変わり、ＺＣＬＶ方式やＺＣＡＶ方式による回転制御で情報を記録及び再生する場合ではメディア回転周波数も変わる。

【００１１】

【発明が解決しようとする課題】しかしながら、上述した従来のレーザ発光パワーの制御方式のように、平均化手段の周波数特性を固定にすると、ＣＬＶ方式でフォーマットした光ディスクをＣＡＶ方式による回転制御で情報を記録及び再生する場合、例えば、内周側記録再生速度に調整値を固定した場合、外周では情報の記録再生速度に較べてレーザパワー制御帯域が非常に低くなるので、レーザパワーが最適値からずれた状態で記録又は再生する情報量が多くなってしまい、正確な記録と再生ができないという問題があった。

【００１２】また、外周側記録再生速度に調整値を固定した場合、内周では光パワー変調成分が減衰されなくなり、平均化不足になるという問題があった。このように、周波数特性を固定にした平均化手段では常に最適なレーザ発光パワー制御を行なうことができないという問題があった。

【００１３】この発明は上記の点に鑑みてなされたものであり、ＣＬＶ方式によるフォーマットの光ディスクにＣＡＶ方式等のＣＬＶ以外の光ディスク回転制御方式で情報を記録又は再生するとき、低コストで常に最適なレーザ発光パワーに制御できるようにすることを目的とする。

【００１４】

【課題を解決するための手段】この発明は上記の目的を達成するため、記録媒体上に記録する情報に応じて半導体レーザ素子のレーザ駆動電流の制御信号を変調する変調手段と、上記半導体レーザ素子から出力されたレーザ光を受光して電気信号に変換する受光手段と、その手段によって変換された電気信号を平均化する平均化手段と、その手段によって平均化された電気信号に応じて上記レーザ駆動電流を変更する制御手段を備えたレーザ出力制御装置において、上記平均化手段の周波数特性を可変にする手段を設けたものである。

【００１５】また、上記のようなレーザ出力制御装置において、上記記録媒体上のレーザ光の集光点の半径位置を検出する半径位置検出手段と、その手段によって検出された半径位置に応じて上記平均化手段の周波数特性を変更する手段を設けるとよい。

【００１６】さらに、上記のようなレーザ出力制御装置において、上記記録媒体上に記録されている回転情報を検出する回転速度検出手段と、その手段によって検出された回転情報に応じて上記平均化手段の周波数特性を変更する手段を設けるとよい。

【００１７】また、上記のようなレーザ出力制御装置において、上記平均化手段によって平均化された電気信号にオフセットを加えるオフセット加算手段と、その手段によって加算するオフセット量を上記半径位置検出手段によって検出された半径位置に応じて変更する手段を設けるとよい。

【００１８】さらに、上記のようなレーザ出力制御装置において、上記平均化手段によって平均化された電気信号にオフセットを加えるオフセット加算手段と、その手段によって加算するオフセット量を上記回転速度検出手段によって検出された回転情報に応じて変更する手段を設けるとよい。

【００１９】また、上記のようなレーザ出力制御装置において、上記平均化手段によって平均化された電気信号にオフセットを加えるオフセット加算手段と、上記変調手段によって変調されたレーザ駆動電流の制御信号の時間幅を変更する時間幅調整手段と、その手段によって時間幅が変更された制御信号に応じてオフセット量を変更する手段を設けるとよい。

【００２０】さらに、上記のようなレーザ出力制御装置において、上記記録媒体上にレーザ光を集光し、上記記録媒体からの反射光を上記受光素子とは異なる他の受光素子上に再び集光すると共にレーザ光の一部を上記受光素子上に照射する光学系手段と、上記他の受光素子から上記記録媒体上の情報を検出する再生手段と、上記他の受光素子から上記記録媒体と集光されたレーザ光の位置情報を検出するサーボ信号演算手段と、上記位置情報に基づいて上記記録媒体上のレーザ光の位置を制御するサーボ手段と、上記レーザ光の位置を移動させる機構系手段を設け、上記レーザ駆動信号に基づいて上記半導体レーザ素子からレーザ光を出射して上記記録媒体上に情報

を記録するようにするとよい。

【００２１】

【発明の実施の形態】以下、この発明の実施の形態を図面に基づいて具体的に説明する。図１は、この発明の一実施形態であるレーザ出力制御部の構成を示すブロック図である。

【００２２】変調部１は、入力される記録情報信号：ｓｉｇ１に応じたレーザ駆動部２のレーザ駆動制御信号：ｓｉｇ２を生成する。このレーザ駆動制御信号：ｓｉｇ２は、レーザダイオード１２の発光レベル（例えば、Ｐｒ、Ｐｃ、Ｐｗ）に応じたイネーブル信号にする。

【００２３】レーザ駆動部２は、レーザダイオード１２の発光レベル毎に応じた定電流源部３の出力を選択し、レーザダイオード１２を駆動して発光させる。受光部４は、レーザダイオード１２から出射されたレーザ光を受光できるように配置された受光素子１７を接続し、受光素子１７によって受光したレーザ光を電気信号に変換し、その出力信号：ｓｉｇ３を出力する。

【００２４】平均化部５は、速度信号生成部９から出力された速度信号：ｓｉｇ５によって周波数特性が可変であり、受光部４から入力された出力信号：ｓｉｇ３から記録情報信号：ｓｉｇ１に応じた光パワー変調成分を除去し、低域成分の発光レベル信号：ｓｉｇ４のみにして出力し、電圧－電流変換器（Ｖ／Ｉ）８を通して定電流源部３の出力を調整する。

【００２５】オフセット加算部６は、オフセット制御信号生成部１０から出力された制御信号：ｓｉｇ６に基づいて発光レベル信号：ｓｉｇ４を調整する。時間軸調整部７は、変調部１で生成される光パワー変調幅を調整する微調整情報を出力する。

【００２６】図２は、図１に示したレーザ出力制御部を備えた情報記録再生装置の構成を示すブロック図である。この情報記録再生装置は、コントローラ２７から出力された記録情報をレーザ出力制御部１１に入力し、レーザ出力制御部１１から出力されたレーザ駆動信号はレーザダイオード１２を駆動してレーザ光線を出射する。

【００２７】レーザダイオード１２から出射されたレーザ光はコリメートレンズ１３で並行光にされ、ビームスプリッタ１４で反射され、対物レンズ１５で記録媒体（メディア）３０上の記録面に集光される。メディア３０で反射したレーザ光は再び対物レンズ１５を通り、ビームスプリック１４を通過し、集光レンズ１６で受光素子１７上に集光させる。そして、受光素子１７で電気信号に変換され、再生回路３１とサーボ信号演算回路２２と回転情報検出回路２３に供給される。

【００２８】一方、レーザダイオード１２から出射されたレーザ光の一部は、そのまま集光レンズ１８で受光素子１９に集光され、レーザ出力制御部１１に送られる。その後、再生回路２１でデジタル化された情報再生信号は後段の情報復調回路に送られる。また、回転情報検出回路２３では、メディア３０上に記録されている回転情報信号を検出する。

【００２９】例えば、ＣＬＶ方式でフォーマットされたＣＤ－Ｒメディアは、線速一定で制御できるように溝の蛇行によるウォブル（Ｗｏｂｂｌｅ）が刻まれている。したがって、ウォブルが略一定周期一線速一定なので、ＣＡＶ方式の回転制御で回転させると、ウォブルは一定周期ではなくなり、線速を示す信号として利用できる。

【００３０】また、サーボ信号演算回路２２では、メディア３０上のレーザ光のレーザスポットの位置情報を演算し、その演算結果に基づいてサーボ回路２４はサーボモータ２５を用いて機構系２０を移動し、コントローラ２７から受けた指示によってレーザスポットの位置を目標位置に制御する。サーボモータ２５は、機構系２０のメディア半径方向の位置検出機能も備えている。

【００３１】平均化部５に入力された速度信号：ｓｉｇ５は、サーボモータ２５から出力された半径位置情報信号や、回転情報検出回路２３から出力された回転情報信号であり、この信号によって平均化部５の周波数特性を変更する。また、サーボ回路２４は、回転情報検出回路２３からの出力に基づいてメディア３０を回転させるスピンドルモータ２６を制御する。

【００３２】すなわち、上記各部がそれぞれ以下の機能を果たす。上記変調部１が、記録媒体上に記録する情報に応じて半導体レーザ素子のレーザ駆動電流の制御信号を変調する変調手段の機能を果たし、上記受光部４が、半導体レーザ素子から出力されたレーザ光を受光して電気信号に変換する受光手段の機能を果たす。

【００３３】また、上記平均化部５が受光手段によって変換された電気信号を平均化する平均化手段の機能を果たし、上記平均化部５及び電圧－電流変換器（Ｖ／Ｉ）８が、平均化手段によって平均化された電気信号に応じてレーザ駆動電流を変更する制御手段の機能を果たす。さらに、上記速度信号生成部９が、平均化手段の周波数特性を可変にする手段の機能を果たす。

【００３４】また、上記サーボモータ２５が、上記記録媒体上のレーザ光の集光点の半径位置を検出する半径位置検出手段の機能を果たし、上記速度信号生成部９が、半径位置検出手段によって検出された半径位置に応じて平均化手段の周波数特性を変更する手段の機能を果たす。

【００３５】さらに、上記回転情報検出回路２３が、記録媒体上に記録されている回転情報を検出する回転速度検出手段の機能を果たし、上記速度信号生成部９が、回転速度検出手段によって検出された回転情報に応じて平均化手段の周波数特性を変更する手段の機能を果たす。

【００３６】また、上記オフセット加算部６が、平均化手段によって平均化された電気信号にオフセットを加えるオフセット加算手段の機能を果たし、オフセット制御信号生成部１０が、オフセット加算手段によって加算す

るオフセット量を半径位置検出手段によって検出された半径位置に応じて変更する手段と、オフセット加算手段によって加算するオフセット量を回転速度検出手段によって検出された回転情報に応じて変更する手段の機能を果たす。

【００３７】また、上記時間幅調整部７が、変調手段によって変調されたレーザ駆動電流の制御信号の時間幅を変更する時間幅調整手段の機能を果たし、上記オフセット制御信号生成部１０が、時間幅調整手段によって時間幅が変更された制御信号に応じてオフセット量を変更する手段の機能を果たす。

【００３８】さらに、上記レーザダイオード１２等が、記録媒体上にレーザ光を集光し、記録媒体からの反射光を受光素子とは異なる他の受光素子上に再び集光すると共にレーザ光の一部を受光素子上に照射する光学系手段の機能を果たす。

【００３９】さらにまた、上記再生回路２１が、他の受光素子から記録媒体上の情報を検出する再生手段の機能を果たし、上記サーボ信号演算回路２２が、他の受光素子から記録媒体と集光されたレーザ光の位置情報を検出するサーボ信号演算手段の機能を果たす。

【００４０】そしてまた、上記サーボ回路２４及びサーボモータ２５等が、位置情報に基づいて記録媒体上のレーザ光の位置を制御するサーボ手段の機能を果たし、上記機構系２０が、レーザ光の位置を移動させる機構系手段の機能を果たし、上記レーザ出力制御部１１が、レーザ駆動信号に基づいて半導体レーザ素子からレーザ光を出射して記録媒体上に情報を記録する手段の機能を果たす。

【００４１】次に、この情報記録再生装置の処理を説明する。レーザ出力制御部１１は、平均化部５の出力値を一定とするように各信号の加減算極性を設計する。例えば、ある定電流電源出力でレーザ光を発光させた場合、レーザ光の温度が上昇すると発光パワーが低下する。

【００４２】そこで、そのレーザ光を受光して平均化部５の出力電圧を増加するように逆特性に設計し、この出力電圧のＶ／Ｉ変換後、電流を定電流源出力電流と加算すれば、電流が増加するため、レーザパワーは大きくなり、平均化部５の出力は減少し、これを繰り返すことで一定値に収束する。すなわち、レーザ発光パワーを一定に保つためには平均化部５の出力を一定に保てばよい。

【００４３】図３は、レーザ温度特性の線図である。レーザダイオード１２の初期状態の温度特性はＴａであり、目標とするレーザ発光パワー：Ｐａを出力するためにはレーザ駆動電流：Ｉａが必要である。しかし、レーザダイオード１２は、長時間発光するとレーザ温度が増加し、温度特性がＴｂになり、同じレーザ駆動電流：Ｉａでもレーザ発光パワー：ＰｂしＩ発光しない。そのため、正確な記録マークを形成するには記録中もレーザ出力を一定に保つ制御が必要になる。

【００４４】図４は、ＣＬＶ方式でフォーマットしたメディアにＣＡＶ方式で情報を記録再生するときの平均化部５の周波数特性を示す線図である。ＣＡＶ方式のため、メディア回転周波数：ｆｓｐは一定周波数である。しかし、ＣＬＶ方式でフォーマットしたメディアのため、メディアの内周の基準クロック周波数：ｆｉｎｎｅｒと外周の基準クロック周波数：ｆｏｕｔｅｒは異なる。

【００４５】メディアの内周と外周のそれぞれへの適正な平均化部５の周波数特性は、図中実線で示す方を内周にし、点線で示す方を外周にすると、基準クロック周波数が特定の減衰量：Ｇｃｌｋとなるような低域通過フィルタ特性になる。

【００４６】なお、実線で示す方を従来のように周波数特性として固定にした場合、外周では情報の記録再生速度に較べてレーザパワー制御帯域が非常に低いので、レーザパワーが最適値からずれた状態で記録再生する情報量が多くなってしまい、正確な記録ができなくなる。また、点線で示す方を従来のように周波数特性として固定にした場合、内周では光パワー変調成分が減衰されなくなって平均化不足になる。

【００４７】さらに、ＺＣＬＶ方式やＺＣＡＶ方式では、基準クロックだけでなくメディア回転周波数：ｆｓｐも変化するため、低域通過フィルタだけでなく、メディア回転周波数：ｆｓｐよりも低い周波数で周波数特性可変の高域通過フィルタ（波線）を入れることも有効である。図４中に矢印Ａで示すのが高域通過フィルタを挿入した場合の波形である。

【００４８】次に、平均化部５の周波数特性変更に関しては、数種類のフィルタを搭載し、そのときの記録速度を示す信号（速度信号）：ｓｉｇ５によって周波数特性を切り替える。また、他には基準クロックを速度信号：ｓｉｇ５にして、これを周波数－電圧変換し、この電圧を可変容量コンデンサや可変抵抗器の制御信号として周波数特性を決定する低域通過フィルタ等で構成することも可能である。

【００４９】図５は、光パワー変調と平均化部５の出力変化の動作を示す線図である。例えば、上記情報記録再生装置として、光パワー変調で記録する光ディスクドライブ、特にＰＷＭ（Ｐｉｔ　Ｗｉｄｔｈ　Ｍｏｄｕｌａｔｉｏｎ）記録を行なう相変化型光ディスクドライブやＷＯＲＭ（追記）ディスクドライブの場合、１つの記録マークを正確に形成するためにレーザ強度を高速多値に変調する。

【００５０】図５の（ｂ）は、３値（Ｐｒ，Ｐｅ，Ｐｗ）のレーザ出力を用いた相変化型光ディスクドライブの記録光源強度変調波形の例を示す線図であり、図５の（ｃ）は、２値（Ｐｒ，Ｐｗ）のレーザ出力を用いたＷＯＲＭディスクドライブの記録光源強度変調波形の例を示す線図である。これらの波形は記録媒体の記録膜特性

によって最適条件が異なる。

【００５１】この情報記録再生装置は、上記波形に限らず、記録マークを形成するのに光源の強度を高速多値に変調する記録方式に適応することができる。なお、図６の（ａ）は、記録光源強度変調波形に対応したメディアトラック上の記録マーク３１を示している。

【００５２】図５の（ｄ）は、同図の（ｂ）の発光波形を受光部４で検出し、平均化部５の出力波形を表した図であり、図５の（ｅ）は同様に同図の（ｃ）の平均化部５の出力波形を表した図である。両図のように記録情報に応じた光パワー変調成分は平均化されているが、低域周波数成分は反映した波形になっている。

【００５３】また、前述したようにＣＡＶ方式では外周に進むほどメディア線速が早くなり、同じ密度の情報を記録再生するための基準クロックも早くなる。この場合、記録マークの正確な形状（長さ、幅）に形成することは難しくなり、記録レーザ発光波形の微調整が必要になる。

【００５４】例えば、ＣＤ－Ｒメディアにおける１倍速と２倍速のように、線速が早くなるとメディアの記録膜に熱が伝わり難くなるため、レーザパワーを強くする。また、ＣＡＶ方式のメディアでは内周と外周で線速が異なるため、記録パワーを変更する（例えば、外周で大きくする）。

【００５５】この場合、平均化部５の出力を測定した一定値になるように制御していては記録レーザパワーは大きくならない。したがって、オフセット加算部６によって平均化部５の出力を任意に変更可能にし、目標記録パワーを変更することができる。

【００５６】また、正確な記録マークを形成するために、記録レーザパワーだけでなく光パワー変調の時間幅も変更するとよい。この時間幅とは、光パワー変調幅を変調部１で生成する場合、基準クロックに比例して変更する通常の時間幅だけでなく、線速に応じた微調整分も含み、時間幅調整部７から変調部１に微調整情報を送ることによって調整する。

【００５７】図６は、光パワー変調の時間幅微調整のときの出力波形を示す図である。図６の（ａ）は、ある長さの記録マーク一個を形成するための３値（Ｐｅ、Ｐｗ，Ｐｂ）の光パワー変調波形を示す図であり、同図の（ｂ）は平均化部５の出力信号の波形図である。

【００５８】なお、図６の（ａ）に、メディア内周で情報を記録するときの光パワー変調波形を実線で示し、そのときの平均化部５の出力信号を図６の（ｂ）に実線で示している。

【００５９】メディア外周では線速が早いので、所望の記録マークを得るには、図６の（ａ）に点線で示すように高パワー発光時間を長くするように微調整する。しかし、平均パワーが変化し、平均化部５の目標値も図６の（ｂ）に示すように、内周での値と異なってしまうので、オフセット加算部６によって微調整することにより、目標値である平均化部５の出力を一定に保てば、各パワーレベル（Ｐｅ，Ｐｗ，Ｐｂ）が変わらないようにする。

【００６０】そこで、オフセット制御信号生成部１０によって半径位置、線速、光パワー変調の情報などの目標パワーの変更を示す信号を生成し、オフセット加算部６に制御信号：ｓｉｇ６として入力する。

【００６１】このようにして、この実施形態の情報記録再生装置は、平均化部５の周波数特性を可変にしているので、記録速度の変更を行なう場合においても、安価な手段で安定したレーザ出力を保つことができる。

【００６２】また、半径位置情報によって平均化部５の周波数特性を変更しているので、半径位置によって記録速度が変わる場合において、安価な手段で安定したレーザ出力を保つことができる。

【００６３】さらに、メディアに記録されている回転速度情報によって平均化部５の周波数特性を変更しているので、メディアの回転方法に関わらず現在の線速に応じてリアルタイムに周波数特性を調整することができ、安価な手段で安定したレーザ出力を保つことができる。

【００６４】また、半径位置や回転速度に応じて平均化部５のオフセット量を変更しているので、半径位置や回転速度に応じて記録パワーを変更する場合にも、レーザ出力の目標値を容易に変更することができ、安価な手段で安定したレーザ出力を保つことができる。

【００６５】さらに、光パワー変調波形の時間幅を変更する際に平均化部５のオフセット量も変更しているので、時間幅を変更したことによる平均値のずれを補正して目標値に制御することができ、安価な手段で安定したレーザ出力を保つことができる。

【００６６】そして、ＣＬＶ方式でフォーマットされたメディアへのＣＡＶ方式による情報の記録時などのような記録速度が変わる装置に適用した場合、安価で安定したレーザ出力を保つことができる。

【００６７】

【発明の効果】以上説明してきたように、この発明によるレーザ出力制御装置によれば、ＣＬＶ方式によるフォーマットの光ディスクにＣＡＶ方式等のＣＬＶ以外の光ディスク回転制御方式で情報を記録又は再生するとき、低コストで常に最適なレーザ発光パワーに制御できるようにすることができる。

【図面の簡単な説明】

【図１】この発明の一実施形態であるレーザ出力制御部の構成を示すブロック図である。

【図２】図１に示したレーザ出力制御部を備えた情報記録再生装置の構成を示すブロック図である。

【図３】レーザ温度特性の線図である。

【図４】ＣＬＶ方式でフォーマットしたメディアにＣＡＶ方式で情報を記録再生するときの平均化部５の周波数

特性を示す線図である。

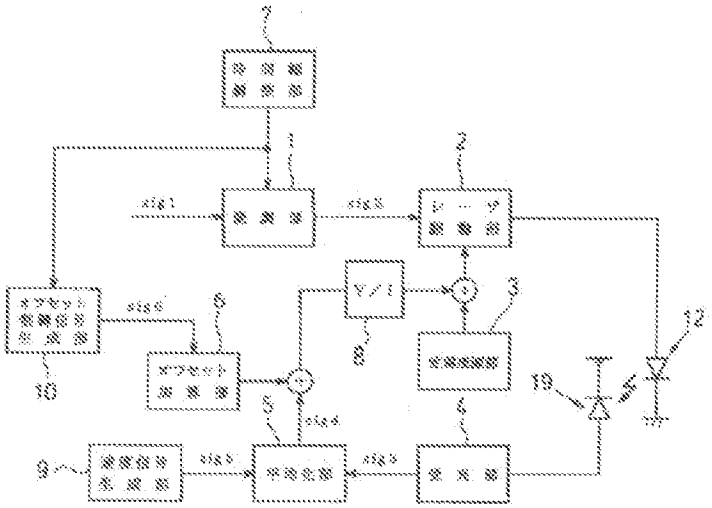
【図５】光パワー変調と平均化部５の出力変化の動作を示す線図である。

【図６】光パワー変調の時間軸微調整のときの出力波形を示す図である。

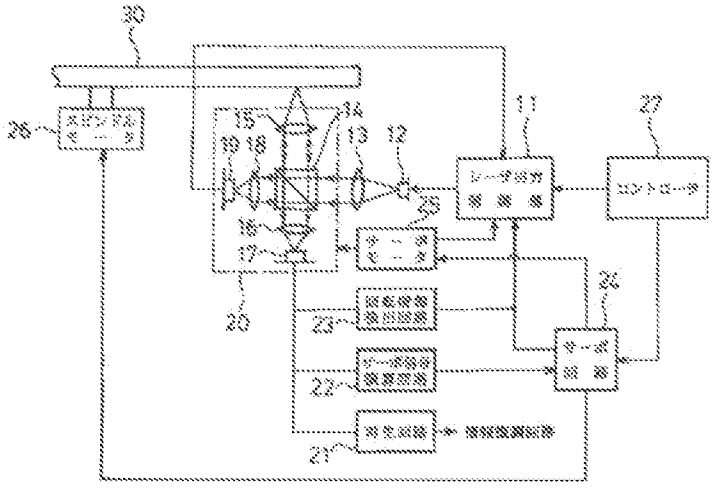
【符号の説明】

１：変調部　２：レーザ駆動部
３：定電流源部　４：受光部
５：平均化部　６：オフセット加算部
７：時間軸調整部　８：電圧－電流変換器（Ｖ／Ｉ）
９：速度信号生成部
１０：オフセット制御信号生成部
１１：レーザ出力制御部　１２：レーザダイオード
１３：コリメートレンズ　１４：ビームスプリッタ
１５：対物レンズ　１６：集光レンズ
１７：受光素子　１８：集光レンズ
１９：受光素子　２０：機構系
２１：再生回路　２２：サーボ信号演算回路
２３：回転情報検出回路　２４：サーボ回路
２５：サーボモータ　２６：スピンドルモータ
２７：コントローラ　３０：記録媒体（メディア）
ｓｉｇ１：記録情報信号
ｓｉｇ２：レーザ駆動制御信号
ｓｉｇ３：受光部からの出力信号
ｓｉｇ４：発光レベル信号
ｓｉｇ５：速度信号
ｓｉｇ６：制御信号

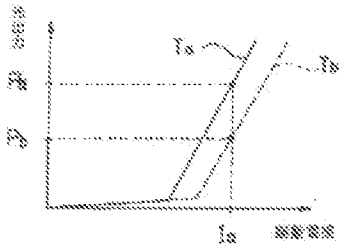
【図１】



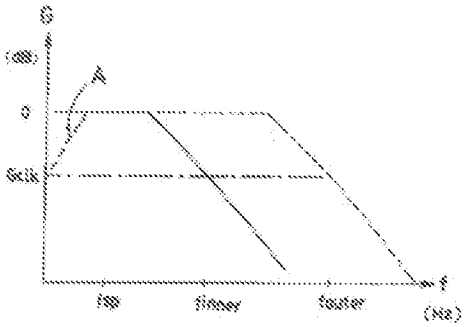
【図２】



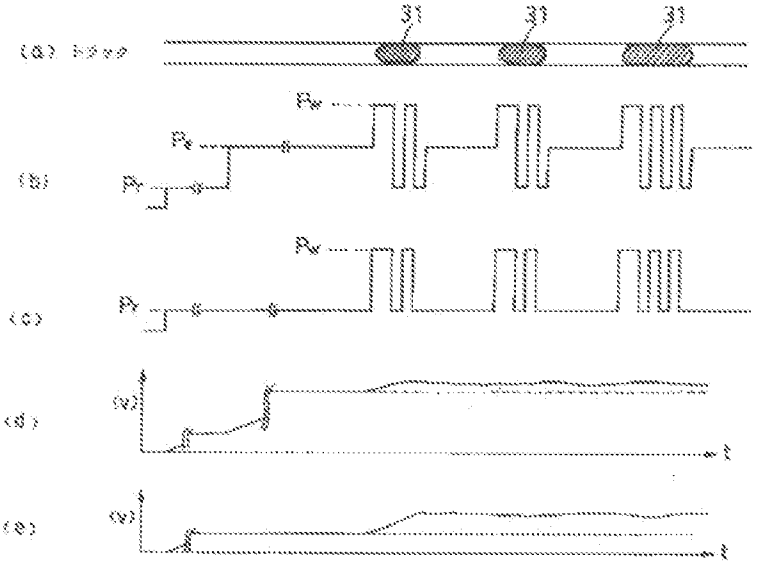
【図３】



【図４】



【図5】



【図6】